Claude L. Clark
1961 Albert Sauveur
Achievement Award

STACKS

June, 1961

MR

METALS REVIEW

The News Digest Magazine

The 16th METALLOGRAPHIC EXHIBIT

Detroit, October 23 to 27, 1961

All metallographers—
everywhere—
are cordially invited to
display their best work.

RULES FOR ENTRANTS

Exhibitors do not need to be members of the American Society for Metals.

Work which has appeared in previous metallographic exhibits held by the American Society for Metals is unacceptable.

Photographic prints should be mounted on stiff cardboard, extending no more than 3 in. beyond edge of print in any direction; maximum dimensions 14 by 18 in. (35 by 45 cm.). Heavy, solid frames are unacceptable.

Entries should carry a label on the *face of the mount* giving:

Classification of entry.

Material, etchant, magnification and other desirable data.

A brief statement (if desired) calling attention to any unusual aspect of the entry.

The name, company affiliation and postal address of the exhibitor should be placed on the *back of the mount* together with a request for return of the exhibit if so desired.

Entrants living outside the United States should send their micros by first-class letter mail endorsed "Photo for Exhibition — No Commercial Value — May Be Opened for Customs Inspection".

Exhibits must be delivered before Oct. 10, 1961, either by prepaid express, registered parcel post or first-class letter mail, addressed:

Metallographic Exhibit
American Society for Metals
Metals Park
Novelty, Ohio, U. S. A.

CLASSIFICATION OF MICROS

Class 1. Irons and steels, cast and wrought
Class 2. Stainless steels and heat resisting alloys
Class 3. Aluminum, magnesium, beryllium, titanium and their alloys
Class 4. Copper, nickel, zinc, lead and their alloys
Class 5. Uranium, plutonium, thorium, zirconium and reactor fuel and control elements
Class 6. Metals and alloys not otherwise classified
Class 7. Series showing transitions or changes during processing
Class 8. Welds and other joining methods
Class 9. Surface coatings and surface phenomena
Class 10. Slags, inclusions, refractories, cermets and aggregates
Class 11. Electron micrographs using replicas
Class 12. Electron micrographs (transmission)
Class 13. Color prints in any of the above classes
Class 14. Results by unconventional technique

AWARDS AND OTHER INFORMATION

A committee of judges will be appointed by the Metal Congress management which will award a First Prize (a medal and blue ribbon) to the best in each classification. Honorable Mentions will also be awarded (with appropriate medals) to other photographs which in the opinion of the judges closely approach the winner in excellence. A Grand Prize, in the form of an engrossed certificate and a money award of $500 from the Adolph I. Buehler Endowment will also be awarded the exhibitor whose work is judged best in the show, and his exhibit shall become the property of the American Society for Metals for preservation and display in the Society's national headquarters.

All prize-winning photographs will be retained by the Society for one year and placed in a traveling exhibit to the various Chapters.

43rd NATIONAL METAL CONGRESS & EXPOSITION

Cobo Hall, Detroit——————————Oct. 23 to 27, 1961

June, 1961 Vol. XXXIV, No. 6

METALS REVIEW

The News Digest Magazine

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Published monthly at 404 N. Wesley Ave., Mount Morris, Ill., by the American Society for Metals. Editorial and general offices Metals Park, Novelty Ohio: W. A. Pennington, President; C. E. Swartz, Vice-president; R. J. Raudebaugh, Treasurer; Merrill A. Scheil, Secretary; C. H. Samans, A. R. Fairchild, Morris Cohen and John Convey, Trustees: Walter Crafts, Past President; Allan Ray Putnam, Managing Director. Subscriptions, $3.00 per year ($7.50 foreign). Single copies $1.50. Second class postage paid at Mount Morris, Ill. and at additional mailing offices.

Claims for missing numbers will not be allowed if received more than 60 days from date of issue. No claims allowed from subscribers from overseas, or because of failure to notify the circulation department of a change of address or because copy is "missing from files".

The Editor's Page

If some recently observed actions can be taken as signposts, those of us participating in or observing the metals scene will see a gloves-off battle for materials markets and applications. Steel vs. aluminum appears to have the center ring at the moment and, according to early rounds, could become quite a slugging match.

Some of the anticipated battles will cover many fronts. While metals have at each other, they must watch their flanks and prepare to carry on equally strong side battles against the onslaughts of plastics, ceramics and other nonmetallic materials for many applications.

For many years, materials producers have been reluctant to go into print with adverse comment about competitive materials. This attitude now seems to have changed. Perhaps the strong advertising campaigns of margarine vs. "The high priced spread" and rayon vs. nylon in auto tires have broken down an established reserve against speaking out against competitors.

Other Visitors

Two geographical extremes of the British Empire were represented by recent visitors to Metals Park. From Melbourne, Australia, came Jack Ritchie, who is honorary secretary of the Australian Institute of Metals. From London came Anthony Post and Henry Cleere, serving as staff representatives of the Iron and Steel Institute. The latter pair were here to make advance plans for a visit next fall by some 250 members of the Institute. More than one-third of the group will be guests of ASM at the Metal Show and Congress in Detroit.

Cooperation

How well local ASM chapters can perform in cooperating with the National organization was vividly demonstrated recently by the Texas Chapter in Houston. A trio from Metals Park recently visited Houston to consider that city as the site of a regional conference and exhibition. It appeared the local chapter people had the entire city of Houston alerted for our visit. At various times we had the opportunity of talking with top editors of Houston daily papers, responsible officials of the Chamber of Commerce and representatives of some forty industries operating in the region. As a result of the fine preparatory work, it now seems likely a regional conference and exhibition will be staged around the topic "Materials and Materials Processing for the Petroleum, Petrochemical and Chemical Industries". Tentative dates are Apr. 17, 18 and 19, 1962.

Success Story

Perhaps it is too early to make definite predictions, but early returns indicate that ASM's new publication "Metals Engineering Quarterly" is going to be a resounding success. The first printing was a complete sell-out and subscriptions are continuing to come in. The second issue recently went into the mails. It contains papers from the National Metal Congress, Western Metal Congress and the Albuquerque ASM-AEC Symposium. Programs planned for forthcoming Congresses and Conferences indicate a continuing flow of good papers for MEQ.

Help Wanted

No doubt many ASMers have heard some talk about the Materials Comparison Center which will be a feature of this fall's Metal Show in Detroit. It will take the cooperative efforts of literally hundreds of people to build the Center to its maximum effectiveness. Many individuals now reading this item will be among those asked to supply a part, a sample of metal, a photograph or data. Any and all assistance will be welcome. Those of us involved in creating the Materials Comparison Center are convinced it will have an extremely high educational and interest value level and will be a "first" as far as Show presentations are concerned.

Materials Barrier

Our friends in several industries —but primarily the aerospace industry—tell us that materials problems are now "number one" in their engineering objectives. A few years ago, they say, it was recognized that someday advances in propulsion systems and airframe design would extend commercially available materials to their limits. Evidently, the "someday" to which they referred is now here. As a result, the materials engineer is now the key man in our space program. The new situation should, in turn, create a demand for properly trained materials experts. Through its local and national activities ASM will gear its efforts to provide these trained people.

J. A. Fellows *J. W. Sweet* *J. G. Jackson* *R. J. Raudebaugh* *Carl E. Swartz*

1961-1962 NATIONAL OFFICERS ARE NOMINATED

The ASM Nominating Committee, meeting in Cleveland on May 22, has announced nominations for five new national officers and trustees of the Society for 1961-1962. Committee chairman is Harold G. Warrington, manager of sales and technical services, Dominion Magnesium Ltd., Toronto.

Carl E. Swartz, presently national vice-president, is the Committee's choice for president; Robert J. Raudebaugh, now national treasurer, is nominated for vice-president; Joseph G. Jackson, Philadelphia, is the nominee for treasurer; Merrill A. Scheil will serve the second year of a two-year term as national secretary.

The Committee also announced its nominations for two new national trustees to succeed retiring Walter Crafts, Albert R. Fairchild and Carl H. Samans. The nominees are John A. Fellows, St. Louis, and John W. Sweet, Puget Sound. Present trustees continuing for 1961-1962 are Morris Cohen and John Convey. William A. Pennington, now serving as national president, will serve an automatic one-year term as trustee.

According to the ASM Constitution, additional nominations for any of the five posts—president, vice-president, treasurer and two trustees—can be made by written petition to Merrill A. Scheil, secretary of the Society. Petitions must be signed by 50 members of the Society and received at ASM headquarters before July 15, 1961. If no additional nominations are received prior to the stated deadline, nominations shall be declared closed and the secretary will cast the unanimous vote of the members for these candidates at the Annual Meeting in Detroit.

Carl E. Swartz

Carl E. Swartz, consultant in metallurgy and materials, specializes in research and administration in non-ferrous metals, welding and joining and in production and casting equipment. He holds or shares 15 U.S. patents on engineering aspects of metals.

Dr. Swartz, a 25-year member of the Society, has been unusually active in four of the ASM's 117 chapters. He served on the executive committees of the Cleveland, Washington and Chicago Chapters and was Cleveland chairman in 1941-1942. In 1954 he was instrumental in the formation of the Chicago-Western Chapter and served as its first chairman, 1954-1956.

Nationally, he was chairman of the Long-Range Planning Committee and member ex-officio of various subcommittees. He held memberships on the Nominating Committee, 1943, and the *Metal Progress* Advisory Committee, 1944-1946. He was a member of the national Board of Trustees, 1956-1958, and is currently serving as vice-president.

After receiving his B.S. degree from the University of Illinois in 1923, Dr. Swartz earned his master's and doctorate from the University of Wisconsin in 1924 and 1926. His exacting and varied background has included heading the Armour Research Foundation's Metals Research Dept., 1950-1952. Prior to that he was division engineer for Kellex Corp., scientific investigator with the U.S. Technical Intelligence Information Agency in Germany, chief metallurgist for Cleveland Graphite Bronze Co., and research metallurgist for American Smelting & Refining Co.

In addition to ASM, he is a member of AIME, ASTM and SNT. He lives with his wife, Eleanor, in Hinsdale, Ill.

Robert J. Raudebaugh

Robert J. Raudebaugh, nominee for vice-president, has served the Society for over 27 years. He was a national trustee, 1953-1955, and is now completing a two-year term as national treasurer.

A native of Ohio, Dr. Raudebaugh is supervisor of iron-nickel alloys for International Nickel Co., New York. He received his B.S. degree in chemical engineering in 1932 from Carnegie Institute of Technology and a Ph.D. in physical metallurgy from Purdue in 1945.

After six years in research with

Armco Steel Corp., he joined Purdue as instructor in physical metallurgy. From 1944-1948 he was an associate professor of metallurgy at University of Rochester. He then joined the faculty of Georgia Institute of Technology as professor of metallurgical engineering.

From June to September 1952, Dr. Raudebaugh was a member of the Research Laboratory staff of International Nickel Co., leaving to become head of the School of Chemical Engineering at Georgia Tech, where he remained until 1954. At that time he rejoined International Nickel, where he is now supervisor of iron-nickel alloys.

He has served as a consultant and staff member at Oak Ridge National Laboratory. As a consultant, he has also been commissioned by the Duncan Electric Co., Lafayette, Ind., and Bausch & Lomb Optical Co., Rochester, N.Y. He is a member of numerous technical societies and has authored several technical papers and a book, Nonferrous Physical Metallurgy. He lives with his wife, Bertha, in Plainfield, N.J.

Joseph Gray Jackson

Joseph Gray Jackson, nominee for national treasurer, will undoubtedly be the first patent lawyer to hold office in ASM. He has been a partner in the Philadelphia law firm of William Steell Jackson and Sons since 1929, except for a period from 1942-1945, when he was metallurgist and assistant chief engineer for Office-Chief of Ordnance, Industrial Service, Artillery Division.

After receiving his B.S. in chemical engineering from Lehigh University in 1926, Mr. Jackson earned a LLB in patent law from University of Pennsylvania in 1929. He did post-graduate work in metallurgy at the Graduate School of the U.S. Dept. of Agriculture, 1942-1945, and completed an ASM evening metallurgy course at Temple University in 1932.

Beginning in 1937, he has served 18 years on various committees of the Philadelphia Chapter ASM and was chairman of several committees for ten of those years. He was assistant secretary from 1937 to 1940, vice-chairman in 1949 and chairman in 1950. He was a member of the national Nominating Committee, 1951, and the national Educational Committee, 1952.

His many memberships include the Bar of the Pennsylvania Supreme Court and U.S. Supreme Court, 1960-1961 chairman of the Patent, Trademark and Copyright Section, American Bar Association and the Board of Managers of the Franklin Institute. He is a former president and treasurer of the Engineers' Club of Philadelphia, former president and secretary of the Philadelphia Patent Law Association and former chairman of the Science and Arts Committee of the Franklin Institute. Other memberships include the National Lawyers Club, ASTM and National Society of Professional Engineers.

He is a registered professional engineer (metallurgical) in Pennsylvania, and has authored and co-authored a number of articles and books. He is an instructor in effective speaking at the Engineers' Club of Philadelphia and at various adult schools for over 20 years. He is married to the former Miriam Howarth.

John A. Fellows

John A. Fellows, nominee for national trustee, is assistant technical director-research and development, for Mallinckrodt Chemical Works, Uranium Div., St. Charles, Mo. He has been active in the St. Louis Chapter and is its chairman-elect for 1961-1962.

A Phi Beta Kappa, he majored in physics at Williams College, receiving his A.B. degree in 1928. He earned his M.S. degree in physics at Massachusetts Institute of Technology in 1932 and Sc.D. degree in physical metallurgy from that school in 1942. While pursuing his graduate work at MIT in physics and metallurgy, Dr. Fellows served as an industrial research fellow with Babcock & Wilcox Co. and American Brake Shoe Co., engaging in high-temperature creep testing. In 1937 he joined American Brake Shoe.

His industrial experience has included development work in foundry practice, heat treatment of alloy steels, creep testing of high-temperature, high-strength alloys and selection of alloys for superior resistance to abrasion. During the war, Dr. Fellows was assigned to the Manhattan Project with responsibilities related to manufacture of the barrier for the gas diffusion plant at Oak Ridge. Since 1953 he has been associated with Mallinckrodt Chemical Works in charge of metallurgical development work in uranium metal processing.

Along with his outstanding efforts in behalf of the St. Louis Chapter, he was a joint recipient of the ASM Henry Marion Howe Medal in 1944. He is active in the AIME, having served as member and chairman of its nuclear metallurgy committee and several IMD committees, and ASTM, now serving on that Society's subcommittee XIII (nuclear reactor materials), committee A-10 and committee E-10. Other memberships include the Institute of Metals (London) and the American Nuclear Society. He is married and has two daughters and a son.

John W. Sweet

John W. Sweet, nominee for trustee, is chief metallurgist for Boeing Airplane Co.'s Aerospace Div., Seattle, where he specializes in metallurgical research and development for airborne, space, ground support and marine vehicles. He holds a B.S. degree in engineering from the University of Washington, 1934. His important contributions to Puget Sound Chapter include active participation and leadership of ten different committees. He was vice-chairman, 1957-1958, and chairman, 1958-1959.

Mr. Sweet has participated in many national activities. He has presented papers in Western and National Metal Congresses, as well as a heat treatment seminar by Puget Sound Chapter. He was a member of the *Metal Progress* Advisory Committee, 1957-1958, and served on the Metals Handbook Committees on properties and application of aluminum and aluminum alloys, 1958. Most recently, he co-authored an article in the November and December 1960 issues of *Metal Progress* on modified 4340 steel. He was a conferee to the World Metallurgical Congress, 1957.

A licensed professional engineer (metallurgical) in Washington, he was nominated by his chapter as Engineer of the Year in 1958. He is a member of AIME and ASTM, and served one year on the Aviation Panel of ASTM's joint committee with ASME for the Effect of Temperatures on Properties of Metals. He was a member of the National Advisory Committee for Aeronautics, 1957-1958, and a company representative on several Aerospace Research and Testing Committee Panels of the Aerospace Industry Association.

He and his wife, Mary Elizabeth, have two children.

DETROIT, HOME OF ASM's *second largest chapter, will be host to the 1961 Metal Congress and Exposition in October. At the May 4 ceremonies when ASM signed the Contract for Cobo Hall are, seated, Mayor Miriani of Detroit and Allan Ray Putnam, ASM managing director, and, standing, Stephen T. Kish, director of the Detroit Civic Center Commission and A. P. Ford, ASM director of communications.*

METAL CONGRESS TECHNICAL SESSIONS—DETROIT, OCT. 21-27, 1961

ASM MEMBERS ATTENDING the 43rd National Metal Congress and Exposition, Oct. 23-27, 1961, in Detroit, will find something entirely new in convenience. For the first time, all technical sessions of ASM, plus the anticipated 250 educational exhibits will be located under one roof—fabulous new Cobo Hall. Final contract signing ceremonies took place May 4 in the office of Mayor Miriani of the Motor City.

According to the *Detroit Free Press*, it was a smiling Mayor Miriani who presided at the contract signing. Representing ASM were managing director Allan Ray Putnam and director of communications A. P. Ford. Stephen T. Kish, director of the Detroit Civic Center Commission, signed for the city. The *Free Press* said the Metal Show is "one of the largest shows ever assembled in Detroit".

It will mark the first time in ten years that an ASM exposition and congress have been held in Detroit. Until the completion of Cobo Hall, newest and largest exposition and convention facility in the nation, the Metal Show had simply outgrown Detroit as a meeting site. In signing, Putnam called attention to the sharp improvement in the labor situation that had been plaguing Cobo Hall earlier. "The city is to be congratulated", he said, "on the successful efforts to make Cobo Hall a smooth, well-run convention facility".

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Many technical and industrial societies are combining efforts to make the 1961 Metal Congress an outstanding event. The American Society for Metals is presenting two groups of sessions. One group, developed by the Transactions Committee, is devoted to research papers. The other group, under the guidance of the Metals Engineering Program Committee, features engineering papers.

Other participating groups presenting programs include the Society for Nondestructive Testing, the Institute of Metals Division, The Metallurgical Society of AIME, the American Welding Society, Industrial Heating Equipment Association, American Gas Association, Metal Treating Institute, Metal Powder Industries Federation, Special Libraries Association and Ultrasonic Manufacturers Association.

Also, on the Saturday and Sunday preceeding the Metal Show opening, the ASM Seminar will be presented. The topic this year is "Ultra-High Purity Metals".

In the program listings below are shown session topics. Complete sessions are devoted to the subject matter shown. Complete detailed programs are to be published well in advance of the meeting dates.

Saturday, Oct. 21

ASM Seminar
Ultra-High Purity Metals (I & II)

Sunday, Oct. 22

ASM Seminar
Ultra-High Purity Metals (III & IV)

Monday, Oct. 23
Morning

ASM Transactions Session
(to be announced)
ASM-Metals Engineering Program Committee

Corrosion in Automotive Applications (I)
Society for Nondestructive Testing Session
The Metallurgical Society of AIME
Refractory Metals (I)
Properties of Thin Films
Effects of Surface and Environment on Strength (I)

Afternoon

ASM Transactions Session (to be announced)
ASM-Metals Engineering Program Committee
Corrosion in Automotive Applications (II)
Society for Nondestructive Testing Session
The Metallurgical Society of AIME
Refractory Metals (II)
Effects of Surface and Environment on Strength (II)

Tuesday, Oct. 24

Morning

ASM Transactions Session (to be announced)
ASM-Metals Engineering Program Committee
Cold Forming of Metals (I)
Society for Nondestructive Testing Session
The Metallurgical Society of AIME
Refractory Metals (III)
Titanium in 1975—(I)
Effects of Surface and Environment on Strength (III)
Continuous Casting (I)
Nuclear Fuel Reprocessing (I)
ASM-Industrial Heating Equipment Association
Industrial Oven Applications in Metal Processing

Afternoon

ASM Transactions Session (to be announced)
ASM-Metals Engineering Program Committee
Cold Forming of Metals (II)
Society for Nondestructive Testing Session
The Metallurgical Society of AIME
Nonferrous Metallurgy
Titanium in 1975—(II)
Theory of Work Hardening
Continuous Casting (II)
Nuclear Fuel Reprocessing (II)
ASM-American Gas Association
New Equipment and Techniques in Melting and Heat Treatment

Wednesday, Oct. 25

Morning

ASM Annual Meeting
ASM Campbell Memorial Lecture
The Metallurgical Society of AIME
Vacuum Techniques (I)
High-Purity Iron and Its Dilute Solid Solutions (I)

Wednesday, Oct. 25

Afternoon

ASM Transactions Session (to be announced)
ASM-Metals Engineering Program Committee
New Metal Removal Techniques
ASM-Metal Powder Industries Session (to be announced)
Society for Nondestructive Testing Session
The Metallurgical Society of AIME
Vacuum Techniques (II)
New Materials in the Automotive Field
High-Purity Iron and Its Dilute Solid Solutions (II)

Thursday, Oct. 26

Morning

ASM Transactions Session (to be announced)
ASM-Metals Engineering Program Committee
Nonmetallic Materials
ASM-American Welding Society
New Welding Techniques
Society for Nondestructive Testing Session (to be announced)
ASM-Metal Treating Institute
Can Your Costs be Reduced by Brazing Techniques?
The Metallurgical Society of AIME
Powder Metallurgy (I)

Afternoon

ASM Transactions Session (to be announced)
ASM-Metals Engineering Program Committee
Light Metals
ASM-American Welding Society
CO_2 Welding
ASM-Ultrasonic Manufacturers Association
Recent Advances in Utrasonic Machining, Joining and Flaw Detection
The Metallurgical Society for AIME
Powder Metallurgy (II)

Friday, Oct. 27

Morning

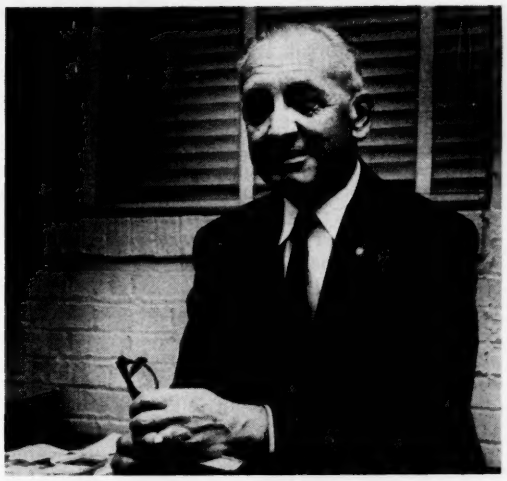
Society for Nondestructive Testing Session (to be announced)

Afternoon

Society for Nondestructive Testing Session (to be announced)
ASM—**Economics in Research and Engineering Through Literature Searching**

Close cooperation between ASM national headquarters and Detroit Chapter leaders mark plans for the 1961 Metal Show. Here discussing the Chapter's role this October are William J. Hilty, ASM exposition manager, Ted C. DuMond, director of chapter and member relations, Jack E. LaBelle, Detroit Chapter vice-chairman and incoming secretary-treasurer, and Robert Sergeson, retiring chairman.

Claude L. Clark, 26th Recipient of Albert Sauveur Achievement Award of the American Society for Metals



The Albert Sauveur Achievement Award

A pioneer in high-temperature research, Claude Clark was "in on the ground floor" as a new field of metallurgy was opening up and has kept abreast of fast moving developments in his chosen profession for over 30 years. Business associates hold the opinion that he has demonstrated a command of his subject which places him among the leaders in the world in his field.

Dr. Clark, who will receive ASM's Albert Sauveur Achievement Award in Detroit this year, is a metallurgist and scientist of high ability. Several of his outstanding achievements have contributed to a basic advance in metals technology. He developed in the early thirties one of the first low-alloy steels for high-temperature service, "DM steel"—which is still in extensive use for tubing in steam generator plants and in the petroleum industry—and conceived and perfected the stress-rupture test, widely used in evaluating alloys for high-temperature applications.

Deeply absorbed in his work, his entire career is characterized by scholarly accomplishment. With prodigious energy he has engaged in research, writing, lecturing, technical committee work and business missions. An impressive record of professional work—over 100 papers and articles have been published in various technical journals —attests to his personal industry and untiring mental activity.

Born in Saginaw, Mich., around the turn of the century, Claude went to the University of Michigan, receiving his B.S.E., M.S.E. and Ph.D degrees at Ann Arbor. During his undergraduate days he held the Arthur Hill Scholarship; as he was working toward his graduate degrees, the Detroit Edison Fellowship was made available. Graduating in 1928, Dr. Clark became one of the first full-time research specialists of professional rank to be associated with the late Prof. Albert E. White, first president of ASM, in the newly formed Department of Engineering Research at the University. This department later grew into the Engineering Research Institute.

While at Michigan, he met his future wife, Irene Hansen, who came from Muskegon and was studying library science at the University. They were married in 1930. Claude is understandably proud of his two children, Jo Anne, 27, who is married to a Michigan Ph.D. graduate presently working at duPont, and Claude Leaman, 22. Lee graduated from West Point at the very youthful age, for the Academy, of 21 in the upper 2% of his class. Now a 2nd Lieutenant in the 2nd Armored Division in Germany, he volunteered for Ranger and parachute training in this country and had several startling "stranger than fiction" adventures while in training.

Dr. Clark remained at the University of Michigan as a lecturer in metallurgical engineering and a research engineer until 1940, when he joined Timken Roller Bearing Co., Canton, Ohio. He was associated with Timken activities long before this, however, since the company was one of the early supporters of contract research on steels for high-temperature applications. At Timken, he developed the "17-22-A" series of low-alloy steels—containing 0.45% C, 1.25% Cr, 0.50% Mo and 0.25% V—widely used in commercial and severe aircraft applications such as aircraft brakes, high-temperature bolting and jet engine compressor parts.

Claude has been very active on the local and national level in ASM and many other technical societies. As a member of the Metals Handbook committee on high-temperature alloys, he contributed substantially to the 1948, 1954 and 1961 editions. He has presented many excellent talks before local ASM chapters and lecture series.

An impressive list of other committee activities keeps him extremely busy. National director of ASTM from 1956 to 1959, he now serves on Committee A-1, steel products, as producer vice-chairman and member of the advisory committee; as chairman of its subcommittee on tubular products (125 members); as a member of Committee A-10, stainless steels; and on the administrative committee for nuclear problems. He is chairman of the panel for the chemical and petroleum industry, of the joint ASTM-ASME research committee on the "Effects of Temperature on Properties of Materials," and serves on the advisory committee, steam-power panel, and data and publications panel. ASME committee activities include the research committee on "High-Temperature Steam Generation," presently doing work on higher than normal (1500° F.) operating conditions; its advisory committee; its metallurgical subgroup (chairman); and the subgroups on metals engineering and tubular products of the boiler and unfired pressure vessel code committee. In addition to holding membership in ASM, ASME, AIME and NACE, he serves on several specialized committees for the American Standards Association and the American Petroleum Institute.

A very respectable golfer in his younger days, Claude admits to having substituted other less strenuous "spare-time" activities, such as gardening, reading and music. A

loyal alumnus of Michigan who follows her fortunes in sports with considerable interest, he also keeps himself well informed on the academic and material progress of the University on his many trips to Ann Arbor to check on Timken research at the Engineering Research Institute. This activity, by the way, was initiated by him in 1928 and has been in continuous operation ever since. In 1953, Claude received a Citation from the University of Michigan during its Centennial of Engineering celebration. Dr. Clark is listed in Who's Who in America and Who's Who in Engineering, and holds memberships in Sigma Xi and Tau Beta Pi.

An outstanding and aggressive research man—more so than most—he gets things done. He is thorough, intellectually honest and has exerted a stimulating influence upon his associates in both the academic and industrial fields. Dr. Clark is the author of the book "High-Temperature Alloys", published by Pitman, and also wrote the 15-lesson Metals Engineering Institute course for ASM on the same subject.

To illustrate his complete grasp of his field of specialization, when he was asked to write the Pitman book, he completed it in less than one year, writing it in his spare time on trains and in hotel rooms, largely without benefit of reference volumes on the subject!—certainly an outstanding testimonial to a man's complete professional development in his chosen field.

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The Albert Sauveur Award was established by the American Society for Metals to recognize pioneering metallurgical achievements which have stimulated organized work along similar lines to such an extent that a marked basic advance has been made in metallurgical knowledge.

Albert Sauveur himself was the first recipient of this honor when it was established in 1934. Affectionately known throughout the metallurgical world as the "dean of American metallurgists", Dr. Sauveur was a pioneering metallographist who produced the first photomicrographs of steel made in the United States. His book on "Metallography and Heat Treatment of Iron and Steel", published in 1912, was a standard textbook for a quarter of a century.

Dr. Sauveur was born in Louvain, Belgium, in 1863 and educated at the Athenee Royal, Brussels, the School of Mines, Liege, and finally at Massachusetts Institute of Technology, graduating in 1889. Later he conducted his own laboratory and published the *Metallographist*, a quarterly which carried most of the important metallographic literature of the day. In 1899 he joined the staff of Harvard University where he established the first university metallographic laboratory. From 1924 to 1939 he was Gordon McKay Professor of Mining and Metallurgy at Harvard.

His important contributions include an improved technique for photomicrography of metals, studies relating to the nature of the constituents of many alloys, the establishment of international nomenclature for these constituents, the discovery of an important procedure in the tempering of steel, and research into the effect of heat treatment on grain size and toughness of iron alloys.

Recipients of the Albert Sauveur Achievement Award

Albert Sauveur—1934
Zay Jeffries—1935
William R. Chapin—1936
Harry W. McQuaid—1938
Stanley P. Rockwell—1939
A. W. Machlet—1940
Albert L. Marsh—1941
Benjamin F. Shepherd—1942
Charles H. Herty, Jr.—1943
Walter E. Jominy—1944
Robert S. Archer—1945
Edgar Collins Bain—1946
F. P. Zimmerli—1947
Marcus A. Grossmann—1949
Clarence E. Sims—1950
Robert F. Mehl—1951
John Chipman—1952
William T. Ennor—1953
Alexander L. Field—1954
W. J. Kroll—1955
Edgar H. Dix, Jr.—1956
Tokushichi Mishima—1957
William G. Pfann—1958
René M. V. Perrin—1959
Bruce Chalmers—1960
Claude L. Clark—1961

Chicago's Man of the Year in Science

Morris E. Fine, chairman of the new Materials Research Center at Northwestern University, is 1960's Chicagoan of the Year in Science. The award—made by the Chicago Junior Association of Commerce and Industry is one of 15 granted to outstanding men in such fields as commerce, industry, education, labor, religion, medicine and the arts.

A leading research scientist and educator in the important field of materials, Dr. Fine pioneered in the interdisciplinary approach to materials education and research. He came to Northwestern in 1954 and while chairman of the then-new department of metallurgy (now materials science), developed it to a position where it is recognized as one of the outstanding departments in the country.

The outstanding work of the department was a major factor in the Technological Institute being chosen as one of three institutions at which the Advanced Research Projects Agency of the Defense Department established a materials research center. (Other centers were etablished at Cornell University and the University of Pennsylvania.) Northwestern's Center brings to the Chicago area a materials research program which will amount to more than $1.5 million annually.

Morris E. Fine

Very active in research, Dr. Fine and his group is generally credited with helping to develop the theory of precipitation hardening which is accepted as the major source of the strength of aluminum, copper and other alloys where zone-type precipitation occurs. Coincidentally, Dr. Fine has just received a two-year renewal of his Air Force research contract. His research group is studying the structure of metal precipitates, examining how, why and how fast they form, and why they make metals strong.

Dr. Fine stated that this award reflects credit on Northwestern's Technological Institute and his colleagues. "Many people have contributed to bringing the Materials Research Center to Northwestern—graduate students and faculty with whom I have collaborated in research and all Northwestern's workers in the broad field of materials, who each deserve as much credit as I. The Center—a joint effort involving the materials science, electrical and mechanical engineering departments, physics and chemistry departments and others —will have a profound effect on the development of industry and research laboratories in the greater Chicago area".

After receiving his Ph.D at the University of Minnesota in 1943, Morris worked two years on the Manhattan (atom bomb) Project, first at the metallurgical laboratory, University of Chicago, and then at the Los Alamos Laboratory in New Mexico. During the next nine years, until he came to Northwestern, Dr. Fine was a research scientist at the famed Bell Telephone Laboratories in New Jersey.

Creative Metallurgy

Clarence G. Bieber of The International Nickel Co., Inc., was the guest speaker at the 28th Annual Sauveur Lecture of the *Philadelphia* Chapter. Discussing "Creative Metallurgy", he reviewed methods of alloy development and described how complex alloys are created to meet increasing demands of modern technology.

It is a continuing effort to satisfy the requirements of advanced engineering concepts by developing new alloys to provide high strength and resistance to corrosion at high temperature. The components of a modern high-temperature alloy are not arrived at by accident, but rather by a careful analysis of what is required and a painstaking combination of the necessary elements to insure the desired end result.

Function of Alloying Elements —Some elements are introduced to give strength to the matrix, others provide precipitation hardening, while so-called minor constituents are added for the purpose of deoxidation or malleabilizing to insure adequate ductility. The ideal situation is to find an element that can perform more than one of these functions.

As an example, he described the functions of the components of Inconel 713C which, in addition to nickel, contains 12% Cr, 5% Mo, 0.12% C, 6.0% Al, 0.6% Ti, 2% Cb, 0.01% B and 0.05% Zr. Chromium acts to strengthen the matrix and also offers resistance to oxidation. Aluminum and titanium contribute to the strength of the alloy through precipitation hardening. This permits alloys to be soft enough in the annealed state to be formed and then by proper heat treatment the necessary hardness is obtained. Aluminum, in addition, provides oxidation resistance. The small amount of carbon reacts with columbium and titanium to produce carbides which precipitate during solidification for dispersion hardening. The addition of small amounts of boron and zirconium counteract impurities in the alloy which can be detrimental. Extreme caution must be exercised in the addition of boron, as too much of it can make the alloy brittle.

Clarence G. Bieber—For many years works metallurgist at Inco's Huntington, W. Va., Works, Mr. Bieber is head of the Special Alloys Section of Inco's Research Laboratory at Bayonne, N.J. Since joining the company in 1924, he has been responsible for the development of many commercial alloys.

Also discussed were the new 20-25% nickel steels, which combine the precipitation-hardening mechanisms employed in nickel-base superalloys with the martensitic transformation (responsible for high strength in alloy steels). These nickel alloy steels therefore combine a greater degree of strength and ductility than is possible with other high-strength alloys.

Announce Translation

As part of its service to the foundry industry, the British Cast Iron Research Assoc. has undertaken the publication of a complete cover-to-cover translation of the monthly Russian foundry journal *Liteinoe Proizvodstvo*, to appear under the title *Russian Castings Production*.

The first edition of *Russian Castings Production* (the January 1961 issue of *Liteinoe Proizvodstvo*) was published in May 1961. Publication will normally be four months after date of Russian issue.

Subscription rate for 12 issues is $35 outside the United Kingdom. Single copies may be purchased for $5.

Orders should be addressed to the Publications Officer, British Cast Iron Research Assoc., Bordesley Hall, Alvechurch, Birmingham, England.

IMPORTANT MEETINGS

June 11-23—Pennsylvania State University. Summer course on Solid State Mechanics. (Information from Engineering Seminars, Conference Center, Penn State University, University Park, Pa.)

July 10-21—Massachusetts Institute of Technology. Summer course on Strain Gages, Fundamentals and Applications. (Information from Summer Sessions Office, M.I.T., Cambridge 39, Mass.)

Aug. 14-18—Infrared Spectroscopy Institute, Canisius College, Buffalo, N.Y. (Information from Dr. Herman A. Szymanski, Director, Infrared Spectroscopy Institute, Canisius College, Buffalo 8, N.Y.)

Aug. 27-Sept. 1—Pennsylvania State University. Short course on Materials Under Thermal Stress. (Information from Engineering Seminars, Conference Center, Penn State University, University Park, Pa.)

Full-Speed Ahead for ASM Information Searching With Arrival of New GE-225 Electronic Librarian

After a year and a half of successful operation on experimental and temporary equipment, ASM's electronic Information Searching Service will proceed full-speed ahead with the new G-225 computer, an "electronic librarian" that can search through encoded digests of technical articles at the rate of close to 100,000 per hr. Arrival of the new machine signals a renewed effort on the part of the Society to tell American industry, science and research that this new problem solving service, advanced as it is in concept, is here, is available now, and fully operational.

Marjorie R. Hyslop, ASM manager of documentation, estimates the service—first mechanized literature searching project in large-scale operation—can save industry more than millions of dollars annually in research costs. By maintaining an up-to-the-minute awareness of what others are doing, as reported in scientific and technical journals across the world, American industry can materially reduce costly and time-consuming duplication of research effort.

Mrs. Hyslop, who has guided the project since its beginning in 1955, has recently relinquished her duties as managing editor of *Metal Progress* to become full-time manager of the ASM documentation service. Timeliness and thoroughness, she states, are the most important characteristics of the Information Searching Service, with the bonus of sharply reduced costs. It can make significant slashes in the all-important "time lag" between conception of an idea and production of a product.

With ASM's mechanized searching system, information on everything published on any aspect of metals and closely allied subjects can be on the desks of American industry *within two to three weeks after publication.* This compares with the weeks, months and sometimes years involved in traditional methods of tedious and costly, page-by-page library searching. In fact, states Mrs. Hyslop, under the old system it was simply impossible ever to be aware of everything happening in the field. More technical material is being published today than can be read by technical people.

"Electronic Librarian", the new GE-225 information processing system, is now installed at Western Reserve University, enabling ASM's Information Seaching Service to proceed full scale. Discussing a subscriber's question are, from left: Allen Kent, associate director of WRU's Center for Documentation and Communication Research; Marjorie R. Hyslop, manager of ASM's Documentation Service; and Jack Belzer, of the WRU staff

Here's how it works: Technical articles, patents and documents on metals and related subjects at the rate of 36,000 per year are read by a team of experts and transcribed into a highly specialized form of indexed abstract — the technical "meat" of each article is carefully retained. These are then encoded into complex language that the GE-225 computer can read, understand and *select.* This information is then placed on magnetic tape which becomes part of the machine library.

And what a librarian is this GE-225! Everyone is familiar with the lightning computation and analysis abilities of modern computers. This one, built by General Electric Co., can read an entire year's output of technical literature in a matter of a few hours. It can answer any question, no matter how general or specific, simple or complex, with incredible accuracy. When a researcher sends in a question like "What has been published on the use of toolsteel compositions in aircraft and missiles", his question is encoded and put to the machine. In a few minutes, the computer produces a stack of references to documents on the subject published within the preceding two weeks, or year, depending on the needs of the subscriber.

The secret behind the success of the computer's operation is a carefully engineered indexing and analysis system developed largely at ASM expense by a Western Reserve University team headed by J. W. Perry and Allen Kent. At once incredibly complex and beautifully simple, this system provides the language by which the computer can communicate information. Six years ago, the Society began operating a pilot project at Western Reserve to ascertain the feasibility of mechanized electronic literature searching to solve the literature problems of American industry. Today, after more than $150,000 invested by ASM and one and a half years of actual operation, the Information Searching Service looks to a future as unlimited as space itself.

What does it cost? $50 per month will keep an engineer, scientist or researcher completely up-to-date on his field of interest—and this is a small fraction of the cost of getting comparable information through traditional library research methods. And the information by electronic searching is current, not months or years late.

ASM Information Searching is here, now. It's available to industry, with a new computer to answer any metalworking question, help solve any problem of metals, materials and process engineering.

High-Temperature Service

Practically all metallic materials have been used at temperatures above room temperature, including unalloyed steel, cast irons, low and high-alloy steels, nonferrous alloys and refractory metals. The three key factors in material selection are surface stability, structural stability and strength. Fabricability and cost indirectly affect the material selection. The relative weight to be given each factor and the method of evaluation depend upon the application.

With these limitations in mind, Russell W. Burman, development manager, Refractory Metals Div., Climax Molybdenum Co. of Michigan, who gave one of four educational lectures on "Metallurgical Principles in Design" in **Akron,** stated that the temperature field can be divided into three parts—temperatures up to 1200°F., where the chromium steels and titanium alloys are dominant; temperatures from 1200-1800°F., where the nickel and cobalt-base superalloys predominate; and higher temperatures, where the refractory metals come into their own.

In the range to 1200°F. the important materials are the chromium, chromium-molybdenum and chromium - molybdenum - vanadium steels and the titanium alloys. When the light weight of titanium alloys is considered, their properties up to 1000°F. become interesting when related to low and medium-alloy steels and the reason for use in aircraft and missile components is readily apparent.

The most useful steels in this temperature range contain from 1-12% chromium for surface and structural stability, usually 0.5-1% molybdenum for structural stability and hot strength and sometimes up to 1% vanadium for hot strength. Steam turbine buckets, refinery still tubes, superheat tubing and pressure vessels are considered typical applications.

In the 1200-1800°F. temperature range, the heat resistant alloys and the superalloys are used. The heat resistant alloys are nickel-chromium alloys or nickel-chromium steels with 15-25% chromium and nickel contents of 35% or more. Typical applications involve furnace and heat treating components in which surface and structural stability are foremost and strength is of secondary concern.

Commercial gas turbines have become a reality largely because cobalt and nickel-base superalloys were developed. As development proceeded, it was found that the highest strength alloys could be obtained with precipitation-hardened nickel-base alloys in which titanium and/or aluminum are effective hardeners. Major applications are found in the aircraft and gas-turbine fields.

The ultimate metallic elements, the refractory metals, possess the greatest potential for elevated temperature service demanding engineering strength. In this group of a dozen metals, availability and high melting point directed a concentrated technical effort upon the "big four" refractory metals—columbium, molybdenum, tantalum and tungsten.

Tungsten has no peer when melting point is the governing criterion, as in rocket nozzles, although the high density can mean a severe weight penalty. It is difficult to machine or fabricate to even simple shapes.

Tantalum fails to yield high-temperature strength commensurate with the high melting point. The metal is relatively high priced but exhibits unusual resistance to chemical corrosion and brittleness at low temperatures.

Columbium has the lowest melting point and elastic modulus of the four but enjoys the advantages of good weldability, fabricability and a low ductile-brittle transition temperature. However, alloying is essential to high-temperature properties and this reduces workability and fabricability.

Molybdenum, with an elastic modulus of 46,000,000 psi., is among the highest of commercial structural materials. On the basis of strength-weight ratio, molybdenum outperforms the other refractory metals at elevated temperatures. High thermal conductivity and low thermal expansion suggest applications involving thermal gradients in service, such as die casting cores and extrusion dies.

The principal deficiency of these four metals is the complete lack of resistance to oxidation at high temperatures. Protective coatings have been successfully applied to molybdenum, offering protection for as long as 200 hr. at 2500°F., 100 hr. at 3000°F., nearly 30 hr. at 3360°F. and some measure of protection at even 3800°F.

The high elevated-temperature strength levels achieved with molybdenum are attributable to the use of three basic metallurgical techniques — strain hardening, solid solution hardening and dispersed phase hardening. Strain hardening offers the most effective method for improving mechanical properties. One of the foremost objectives of solid solution alloying is to raise the recrystallization temperature, thus preserving to the highest possible operating temperature the improved mechanical properties developed by strain hardening.

One of the most interesting developments in recent times has been the discovery of a dispersion hardening mechanism operative in the molybdenum-titanium system. It was concluded from careful experiments that the strengthening by titanium is dependent upon the presence of carbon, the effective dispersion being titanium-carbide particles. *(Reported by Manuel Goldman)*

25-YEAR MEMBERSHIP CERTIFICATES *were presented to St. Louis Chapter Members Robert N. Niewoehner, Frank X. Hohn, J. S. Skoglund, Elliott W. Metz and Charles Brown during a recent meeting*

Elevated Temperature Drawn Steels

Steel bars strengthened by drawing at elevated temperatures, in the range 200°F. to the A_{e_1} temperature, have many advantages over heat treated steels for a wide variety of applications, Elliot Nachtman, director of research and development, LaSalle Steel Co., stated at a meeting of the **New Jersey** Chapter. The advantages comprise such items as lower cost, better machinability and improved surface finish for equivalent performance in the finished part.

The speaker reviewed five methods for strengthening steels or other metals: precipitation hardening; dispersion hardening; subzero deformation of stainless steel; drawing, cold or elevated temperature; and "ausforming", deformation of austenite before transformation to martensite.

The elevated temperature drawing process increases yield strength by as much as 30%. Peaks in strength, accompanied by minima in ductility, are found as drawing (deformation) temperature is raised. These peaks may occur at 500°F. in one steel and 600°F. in another. Residual stresses are greatest at 200°F., the lowest drawing temperature until they are negligible at 900°F.

An active discussion period brought out additional points of interest on elevated temperature drawing: It may improve machining 50% over heat treated steels; although the notch-impact toughness is lower than that of heat treated bars there is sufficient toughness for it to be used successfully in hundreds of applications; bars of AISI 4140 steel as large as 3.5 in. in diameter are being drawn to strengths over 150,000 psi. tensile strength at 700-850°F.; the properties are not obtained by conventional heat treatment; and the deformation is the same on the inner and outer portions of a bar—the key to this is die design but lubrication is also important. *(Reported by O. O. Miller)*

ELEVATED TEMPERATURE DRAWN STEELS *were described by Elliott Nachtman, LaSalle Steel Co., at a meeting in New Jersey. Milton Margolis (right), vice-chairman, presents him his speaker's certificate*

Retaining Rings—Design and Application

The use of stamped retaining rings is a relatively new fastening technique, according to Arnold Bernstein, technical service engineer, Truarc Retaining Rings Div., Waldes Kohinoor, Inc., who spoke at a meeting in **Manitoba.**

The first basic types—an "internal" ring for use in bores and housings and an "external" ring for shafts, studs and similar parts —were introduced in the United States in 1942. They were developed originally for aircraft. Demand for the fasteners in other industries, however, has led to the development of a great many different ring types and sizes designed to satisfy a wide range of assembly and fastening requirements.

While retaining rings often serve more than one purpose in an assembly, their primary function is to provide a removable shoulder for accurately locating, retaining or locking components. The most widely used types are seated in deep annular grooves which provide the assembly with a high thrust load capacity. Self-locking rings which do not require grooves are available for assemblies that are not subjected to any sizable static or dynamic loading conditions. The self-locking rings usually serve as positioning and locking devices.

Unlike wire-formed rings, which have a uniform section height, stamped rings are characterized by a tapered radical width which decreases symmetrically from the center section to the free ends. The tapered construction permits the rings to remain circular after they have been expanded for assembly over a shaft or compressed for insertion into a bore or housing. This constant circularity assures maximum contact surface with the bottom of the groove—an important factor in achieving high static and dynamic thrust load capacities. Another characteristic of the stamped ring is that holes are provided in the lugs at the free ends. The holes are designed to accommodate retaining ring pliers which grasp the rings securely and facilitate assembly and disassembly of the fasteners.

Most rings are stamped from high-carbon spring steel (SAE 1065-1090). For special applications, a number of other materials often are used, including aluminum (Alclad 7075-T6), beryllium copper (Berylco 25), phosphor bronze (Grade D, No. 10 Hard) and corrosion - resistant stainless steels (Armco Ph 15-7 Mo and AISI Type 420). Standard sizes range from approximately 1/16 to 10 in. in diameter, although rings as large as 39 in. in diameter have been produced for special applications. An idea of the number of available standard sizes may be gathered from the fact that, for some ring types, more than 30 diameters are produced between ⅛ and 1 in.

In addition to the basic internal and external rings, a number of different ring types have been developed for specific fastening problems, including: inverted rings, which derive their name from the fact that the lugs have been inverted to abut the bottom of the groove. The rings have an increased section height to provide a higher shoulder, uniformly concentric with the housing or shaft. Inverted rings are used to retain parts with large corner radii or chamfers and provide better assembly clearance and

a more pleasing appearance; bowed rings, similar in appearance to the basic types, these rings are bowed over the horizontal axis to provide resilient end-play take-up in an assembly. They are used widely for preloading bearings and for taking up accumulated tolerances or wear in the retained parts; beveled rings have a 15° bevel on the groove-engaging edge and are installed in grooves with a comparable bevel on the load-bearing wall. The rings provide rigid end-play take-up in the assembly. They are used widely in hydraulic cylinders where a tight seal is critical; radially assembled rings designed for applications where it is impractical to install rings in an axial direction. A number of types are available—crescent rings, which provide a narrow, circular shoulder with maximum assembly clearance, E-rings and reinforced E-rings, where a large shoulder is needed on small diameter shafts, two-part interlocking rings that are secure against high rotational speeds and bowed E-rings and locking prong rings for end-play take-up. The locking prong ring is used widely as a shoulder against rotating parts; self-locking rings do not require grooves. Grip rings, similar in general appearance to the basic external type, exert a frictional hold against axial displacement from either direction and are reusable following disassembly. Various push-on type circular and triangular retainers make use of inclined prongs which grip the shaft; they are secure against displacement from one direction and generally must be destroyed to be removed.

Retaining rings may be used to replace cotter pins, nuts, rivets, set collars, machined shoulders, threaded sleeves, and many other bulkier and more expensive fastening devices and methods. They offer a number of design and production advantages over other fastening and assembly techniques. By reducing the number and complexity of components in an assembly, they often make possible design simplifications with substantial savings in size and weight. The rings eliminate drilling, tapping, threading and other costly, time-consuming machining operations. Accurate location of ring grooves—which often can be cut simultaneously with other production processes—assures precise seating of components and eliminates objectionable binding or end-play. Rapid ring assembly and disassembly further reduce manufacturing costs and facilitate product maintenance and field service.

Nuclear Reactor Materials

Materials problems in nuclear reactors were reviewed by N. J. Palladino, professor and head of the Nuclear Engineering Dept., Pennsylvania State University, speaking at a **Penn State** meeting.

The most important consideration governing the use of materials in nuclear power reactors is successful operation for long periods of time in a radiation field and in contact with the reactor coolant. Apart from the requirement that the materials must have the necessary mechanical properties at reactor operating temperature, they must also be corrosion resistant, not only as determined by the mechanical weakening of the material, but also with respect to the effects of corrosion products on the system. These corrosion products become radioactive to a degree dependent on their composition. By depositing in various areas, they can limit accessibility for maintenance of such items as pumps and valves. Materials selected for the core must be compatible with the requirements for neutron economy and must be able to withstand radiation damage.

The operation of the Westinghouse Atomic Power Reactor at Shippingport, Pa., served as an example for discussion of the problems encountered and the materials used in a working reactor.

The reactor vessel itself is constructed of 8¼ in. steel plate lined on the inside with ¼ in. of Type 304 stainless steel. The cladding is required for corrosion resistance. Type 304 and 347 stainless steels are also used for the thermal shields, which keep gamma rays from heating the vessel and causing thermal stresses, and for general use in the core structure.

The core is made up of two types of fuel elements to form a seed and blanket core. Highly enriched uranium alloyed with Zircaloy is used as the fuel in the seed. The uranium-Zircoloy alloy is in the form of flat-plate fuel elements clad with Zircaloy. The blanket fuel elements consist of fuel rods containing sintered pellets of uranium oxide enclosed in Zircaloy tubes. Metallic uranium cannot be used because it "grows" in a radiation field and corrodes badly in water if a leak in the cladding takes place. Other materials in the core structural components include Inconel-X for springs, 17-4 pH stainless for shafts and bolts and chromium plating for increased wear resistance.

Hafnium is used as the control-rod material because of its high neutron absorption and good corrosion resistance. Cadmium can be used but corrodes under operating conditions and would require cladding. Boron steels are presently being investigated for use as control rods, but the results are not yet available. Some of the other materials used in control-rod mechanisms are Types 304 and 347 stainless for general use; 17-4 pH stainless for screws and ball bearings, Stellite No. 3, 6, 8 and 9 for ball bearings, Type 410 stainless for rotor arms and motor tubes and chromium plate for antigalling material. *(Reported by George Sabol)*

THE OSCAR E. HARDER MEMORIAL LECTURE *held annually by the Columbus Chapter, was given by H. S. Jerabek, University of Minnesota, whose talk was entitle "Metallographic Etching Reagents". Present were A. M. Federico, chairman, Mrs. Harder, wife of the former ASM national president and Dr. Jerabek*

At a joint meeting of the Western Ontario Chapter ASM and the Windsor Section, American Society for Quality Control, August Mohri, Steel Co. of Canada, spoke on "Control of Quality in Steelmaking". From left are J. D. MacBride, ASQC chairman, Norm Eley, ASM chairman, Mr. Mohri, and Guy I. Fiddes, Steel Co. of Canada

Neil J. Culp, Carpenter Steel Co. (left), spoke on "Air Hardening Tool and Die Steels", and William E. Teer, Wright Machinery Co. (right), presented a history of his company at a meeting of The Carolinas Chapter. V. J. Vierling (center), chairman, moderated

Claude H. Leland (left), General Motors Technical Center, who discussed "Furnaces for Special Heat Treating Jobs" at Indianapolis, is shown with Dean K. Hanink, Allison Div., General Motors Corp.

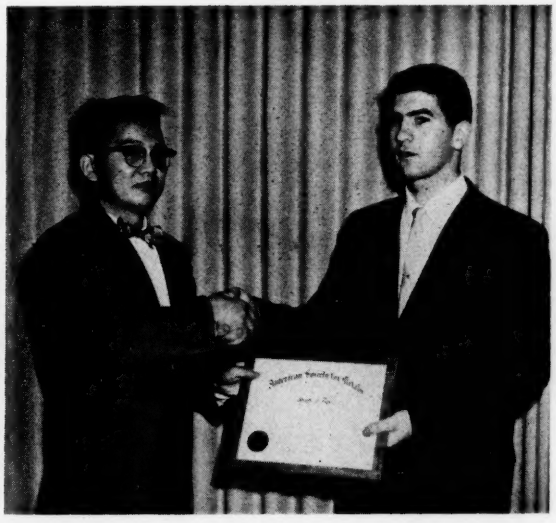
The Indianapolis Chapter entertained its ladies with a film story of the Turbocraft jet boat built by Indiana Gear Works and a talk on the Turbocraft by George Morrison, information director. Shown are: Dean Hanink, vice-chairman, and Mrs. Hanink; Mrs. George Sommers and George Sommers, chairman; Mr. Morrison; Alva Junkins, technical chairman, and Mrs. Junkins; and Mrs. William Unterberg and her husband, who is chapter publicity chairman

Present at a meeting in Worcester were, from left: Harold J. Holmes, chairman, George J. Schad, Carpenter Steel Co., who gave a talk entitled "Four Steps to Better Tools and Dies", and Laurence T. Maher, technical chairman

Officers of the Jacksonville Chapter who discussed ASM national business affairs with Ted DuMond (right), director of chapter and member relations, included Anthony Breda, chairman, Wilbur L. Baker, educational chairman, Douglas L. King, secretary, and John H. Repp, vice-chairman

Tulsa Chapter played host to 200 students and teachers at Students Night Meeting. Kenneth E. Rose, professor of metallurgical engineering, University of Kansas (standing), spoke on "Crystal Gazing". Also shown are Jack Garol, chairman, Dale Davis, vice-chairman, and Bill Bradley, secretary-treasurer

(Left) A. N. Holden, manager, metallurgy and ceramics, General Electric's Vallecitos Atomic Laboratory, James L. Beaton, Notre Dame Chapter chairman, and R. Grey Raudman, Jr., MEI "Student of the Year," shown during a meeting at which Mr. Holden reviewed "Radiation Damage of Metals". (Right) Sumio Yukawa, chairman, Eastern New York Chapter, presents an ASM Scholarship Award to Joseph Pepe, student at Rensselaer Polytechnical Institute



ASM Members Come From Far And Near For Committee Meetings At Metals Park

HOW ASM'S NEW INFORMATION SEARCHING SERVICE WORKS *is discussed by members of the Documentation Committee with Allen Kent, associate director of Western Reserve University's Center for Documentation and Communication Research where ASM's service is being carried out. F. T. Sisco, committee chairman, is standing at right, Kent at left. Seated from left are D. C. Hilty, Electro-Metallurgical Co., Buffalo Chapter, and J. O. Mack, U. S. Steel Corp., Delaware Valley Chapter*

Mr. ASM Member, this is *your* society and *your* building. This basic idea of ASM, service to members, was underscored again last month as three national advisory committees of ASM members met to discuss the Society's outlook at Metals Park. In fact, scarcely a week goes by without one or more of ASM's committees utilizing the excellent conference facilities of the national headquarters building. Hundreds of ASM'ers are hosted by the staff each year.

Most recent visitors were members of the Documentation Committee, Metal Progress Advisory Committee and Long-Range Planning Committee. Coming from many parts of the United States and Canada, and representing many of the ASM's 117 Chapters, these ASM'ers without exception devote entire days to their meetings, with action-packed and productive agendas. That's the idea behind ASM—members getting together, sharing ideas and experiences, working for the good of themselves, their Society and their industry.

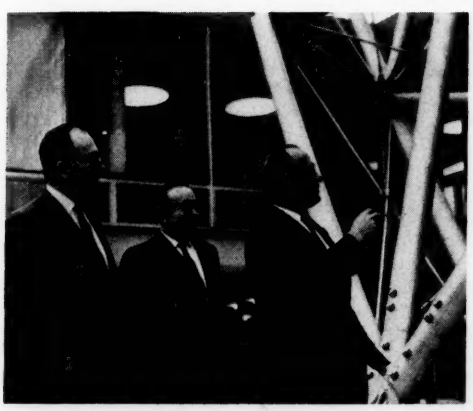
Here, through the camera's eye, are some of these committees at work.

HERE'S THE ASM DOCUMENTATION COMMITTEE AT WORK *in the main conference room at National Headquarters, Metals Park. Committee chairman F. T. Sisco, Alloys of Iron Research, New York Chapter, stands to summarize the committee's recommendations to the ASM Board of Trustees. This is the spirit of ASM—members getting together to share ideas, compare opinions for the benefit of all*

PAST PRESIDENTS GET TOGETHER *during an ASM Long Range Planning Committee meeting at Metals Park. From left: Clarence H. Lorig, 1958-1959 president; G. MacDonald Young, 1957-1958 president; A. O. Schaefer, committee chairman and 1955-1956 president; and Ralph L. Wilson, 1952-1953 president. Mr. Young points to the maple leaf identifying the paneled island in the Board room as a gift of the Canadian Chapter*

- **Documentation**
- **Long-Range Planning**
- **Metal Progress**

TOURING NATIONAL HEADQUARTERS *prior to a meeting of the Metal Progress Advisory Committee are David C. Goldberg, Westinghouse Electric Corp., Pittsburgh Chapter, Robert H. Gassner, Douglas Aircraft Co., Technical Council representative; and Elliott A. Reid, Bethlehem Steel Co., Lehigh Valley Chapter*



KEEPING METAL PROGRESS EDITORS INFORMED *of important developments in metalworking technology is this meeting of the Advisory Committee at Metals Park. W. L. Fleischman, Knolls Atomic Power Laboratory, General Electric Co., Eastern New York Chapter, makes slide presentation on effect of radiation on properties of steel. Watching, from left, are: James Holzwarth, General Motors Corp., Detroit Chapter, R. H. Gassner, Technical Council representative and Metal Progress consulting editor; and Donald R. Johnson, Sandia Corp., Albuquerque Chapter*

ALBERT R. FAIRCHILD, NATIONAL TRUSTEE *and Board Representative to the Long Range Planning Committee, points out interesting construction features of the geodesic dome at National Headquarters to committee members John P. Clark, Jr., John P. Clark Co., Philadelphia Chapter, left, and A. P. Hoelscher, Geneva Steel Co., Utah Chapter*

MEN in METALS

National Secretary ASM, Merrill A. Scheil, director of metallurgical research at A. O. Smith Corp., Milwaukee, was selected by the faculty of the College of Engineering, with the approval of the Board of Regents, as a recipient of a Distinguished Service Citation of the University of Wisconsin for his many contributions to engineering. The award was made at the annual Engineers Day dinner on May 5. Awards were also made to John J. Chyle, director of welding research, A. O. Smith Corp.; William T. Ennor, assistant director of research, Aluminum Co. of American; and Frederick M. Young, founder of the Young Radiator Co.

Mr. Scheil's citation reads: "In recognition of the eminent professional services of Merrill A. Scheil, engineer, author and administrator, who, through technical papers and lectures, effective leadership in many technical organizations, and contributions to national defense, has significantly advanced the profession of metallurgical engineering."

Mr. Chyle's citation reads: "In recognition of the eminent professional services of John J. Chyle, engineer, inventor and administrator, who has contributed significantly to welding techniques for high-strength steels and nonferrous alloys and to his profession through enthusiastic participation in the activities of many technical societies." Mr. Chyle is chairman of the *Metal Progress* Advisory Committee.

Appointments in the newly created combined engineering, research and product development department at U. S. Steel Corp. include Walter L. Longnecker, former Cleveland district manager of operations, who was appointed director, engineering and research and will head the new department; Floyd A. Garman, who will continue to supervise engineering activities as chief engineer; Walter O. Everling, who has been director of research, becomes research consultant; Ronald E. Griffiths, assistant director of research, was named to direct product development.

David Turnbull of the Metallurgy and Ceramics Research Dept., General Electric Research Laboratory, was one of the internationally prominent scientists selected by the Advisory Group for Aeronautical Research and Development of the North American Treaty Organization to participate in the International Materials Science Symposium held in Paris the week of May 9. Dr. Turnbull's paper was on "Thermodynamics and Kinetics of Phase Changes in Solids".

James W. Perry, professor of numerical analysis in the University of Arizona's College of Engineering, was awarded an honorary membership in the American Institute of Chemists at a dinner held on Apr. 22. Dr. Perry, who was

Dr. Perry, left, receives citation from W. G. Parks, University of Rhode Island, and chairman of the honorary membership committee of the Institute.

formerly director of the Center for Documentation and Communication Research at Western Reserve University, has been engaged full time in developing new methods for the retrieval and correlation of recorded information since 1945. The system he developed there has formed the basis for an automatic documentation service introduced this past year by the American Society for Metals (Metals Documentation Service).

He was cited as a "distinguished chemist, perservering author and understanding educator who has made basic contributions to the methods and successful mechanical means for the retrieval of information from the literature. The world has profited from his books and is indebted to him for the achievements of groups which he has organized and directed. In recognition of his devotion to science and to fellow chemists, he has been elected an honorary member of the American Institute of Chemists".

William F. Peschel has recently become associated with Olson Mfg. Co., Royal Oak, Mich., as manager of the Induction Heating Div. He was formerly Detroit district sales manager for Ajax Magnethermic Corp. and also associated with the Tocco Div., Ohio Crankshaft Co. for 12 years in engineering and sales.

John G. Mezoff has been named head of the Technical Service and Development group organized by Dow Chemical Co.'s new Metals Dept. Mezoff has been a section leader for Dow Metal Products since 1959.

D. H. Barbour has been appointed general manager, C. M. Brown assistant to the general manager and R. L. Folkman sales manager of the new Refractory Metals Dept. of the Union Carbide Metals Co.

E. Warren Feddersen has been appointed director of manufacturing development at Convair Div., General Dynamics Corp. He was formerly chief of manufacturing research and development at Convair's Fort Worth facilities.

M. P. Weigel has ben appointed a vice-president of Aluminum Ltd., Montreal. He has been director of operations for the company since 1957.

Robert S. Strimel has been appointed assistant to the president of the Tinius Olsen Testing Machine Co. Strimei has been engaged in a variety of technical, adminstrative and sales capacities in the company over the past 20 years. Most recently he served as director of research, a post he has held since 1954.

Zachary D. Sheldon, formerly manager, advanced materials development, General Engineering Laboratory, General Electric Co., has joined the Carborundum Co. as associate director of the Research and Development Div.

Walter L. Saccani has been made assistant superintendent of the openhearth department at Kaiser Steel Corp.'s Fontana plant.

Loftus Engineering Corp. has announced that Harold E. Metcalfe has been named to its sales engineering staff. Mr. Metcalfe is a mechanical engineer with 20 years

experience in industrial furnace application in the ferrous and nonferrous industry.

C. J. McClintock has been appointed manager of quality control and inspection and Benjamin S. Seward manager of quality assurance by the Hunter Spring Co., a division of American Machine & Metals, Inc.

R. G. Martinek has been named product sales manager of Hevi-Duty Electric Co.'s five furnace and oven product lines. He has been with the company for the past two years.

New chief industrial engineer at Indiana Steel Products Div., Indiana General Corp., is Robert Just, formerly plant manager at Burnham Corp.

J. Heuschkel, welding engineer for Westinghouse Research Laboratories, has been awarded the J. F. Lincoln Gold Medal of the American Welding Society for his paper "Weld Metals in Nickel-Base Alloys". Mr. Heuschkel is presently chairman of the Metals Joining Committee at Westinghouse.

Carl Swift Hallauer, board chairman, Bausch & Lomb Inc., received the Scientific Apparatus Makers Award for his "achievement in developing the industry's capacity for serving the nation in the fields of industry, research, education, health and defense".

Graham W. Corddry and Claude M. Merrell have been elected vice-presidents of National Lead Co. Mr. Corddry, director and member of the company, is manager of the Titanium Div. He joined the company in 1932. Mr. Merrel directs National Lead's foreign operations. He has been with the company since 1935.

Earl J. Conway has been appointed a coatings specialist for Metal & Thermit Corp. Recently the head of his own coatings operations, E.J.C. Associates, he has also served as Detroit sales manager for the Electro-Chemical Engraving Co.

Alfred F. Chouinard, director of research and development of the National Cylinder Gas Div., Chemetron Corp., has been elected president of the American Welding Society. His one year term commenced June 1.

Thomas D. Bushman has been appointed product manager of semiconductor processing equipment at Norton Co.'s Machine Tool Div.

William E. Lowery has joined the Applied Plastics Div. of Hexcel Products Inc. as technical representative. He is former product manager for Dow Chemical Co.

Malcolm C. Hulse, sales engineer at Columbia Steel and Shafting Co., has been appointed manager of laboratory services. He has been with the company since 1933.

OBITUARIES

Nevzat M. Erkun, a member of Beaver Valley Chapter and research metallurgist at Crucible Steel Co. of America's Midland Research Laboratory since 1956 died late in March. Mr. Erkun specialized in titanium alloy research, with special emphasis on heat treatments, A native of Turkey, he had been in the United States for 15 years. He was 38 years old.

Joseph H. Brennan, chief metallurgist for Union Carbide Metals Co., died April. 19 at the age of 58 after a lengthy illness. Mr. Brennan was associated with the ferroalloy industry and employed by affiliates of the Union Carbide Corp. for 26 years. His research was principally designed to determine more economical methods for producing alloys with a low carbon content. He was a co-inventor of a process for treating low-grade tungsten ores, and also collaborated on the design, construction and operation of the cobalt refinery that supplied most of this country's cobalt requirements during the war. He had served as a consultant to the National Research Council, the Manhattan Project and the Atomic Energy Commission.

Mr. Brennan, who owned one of the largest personal libraries in Western New York, was a member of ASM's W. H. Eisenman Rare Books Committee.

ALPHA SIGMA MU, NATIONAL HONORARY *Metallurgical Fraternity, recently initiated the above students from Case Institute of Technology, certificates being awarded at a Cleveland Chapter meeting. At left is Anton deS. Brasunas, corresponding secretary of the Fraternity; at right is A. J. McCullough, Cleveland chairman; second from right is G. W. Form, Case faculty advisor. In addition to the above group, the following universities initiated students, as follows: five at Purdue, five at Colorado School of Mines, one at Montana School of Mines, two at Columbia, 19 at Michigan College of Mining and Technology, four at Lafayette, eight at Lehigh, one at University of Maryland, five at Missouri School of Mines, five at North Carolina State, three at University of Arizona, nine at University of Alabama, one at Washington University and five at Wayne State.*

RESEARCH
R & D NEWS
DEVELOPMENT

Horizontal Zone Refiner

The "Type RHR-1Z23" unit is designed for applications such as zone leveling of germanium bars up to 18 in. long and zone refining of such materials as potassium chloride or bromide. The unit also lends itself to epitaxial growth along with straight diffusion proc-

esses. The furnace has a 54-mm. quartz tube, 40 in. long, and operates up to 1093°C. (2000°F.). The 3-in. long chamber is heated by two ring-type nichrome heating elements which provide uniform heating over a 1-in. length at ± 2.0°C. The furnace is precisely aligned on guide rods and has a maximum linear travel of 24 in. Scanning speed is variable from 0 to 0.9 in. per min. in either direction. The variable speed control provides repeatability settings for all scanning speeds to a resolution of one part in 4000.

For more information write to Lindberg Engineering Co., 2444 W. Hubbard St., Chicago 12, Ill.

Vacuum Diffusion Pump

The "Model HS 4-750" fractionating oil diffusion pump provides 120% higher speed over a one-third wider vacuum range than earlier models and offers lower backstreaming, higher forepressure tolerances and greater capacity. The 4-in. pump has an improved jet assembly and boiler design which assures dependable operation under widely varying conditions. Pump speed peaks at 750 liters per sec. (1600 cu. ft. per min.) between pressures of 1 x 10^{-3} and 3 x 10^{-5} mm. Hg; forepressure tolerance is 650 microns at blank-off and backstreaming is less than 0.02 mg. per sq. cm. per min.

For further information write to NRC Equipment Corp., 160 Charlemont St., Newton 61, Mass.

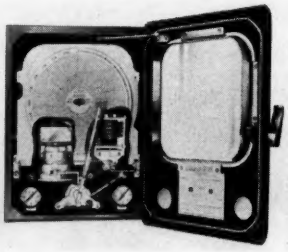
Strain Gage Data Logger

The "Model 179" strain gage logger scans 200 channels at 5 channels per sec. This medium speed, absolute millivolt instrument has a high-speed tape punch system which provides a coded punched tape record of all data. Information can be fed to a tape reader or computer for further analyses or plotting of stress-strain graphs. Either of two full-scale strain ranges (0 to 5000 or 0 to 10,000 micro-in. per in.) can be selected. An alarm system is provided which indicates when a given input exceeds a preset strain value for any channel.

For further information write to Gilmore Industries, Inc., 13015 Woodland Ave., Cleveland 20, Ohio.

Recording Pneumatic Controller

The "Series 532" controller has good frequency response (essentially flat to over 300 cycles per min.), low air consumption (less than 0.1 scfm.), high exhausting capacity (over 3 scfm. at 1 psi. drop), high tolerance to shock and high-temperature stability. The

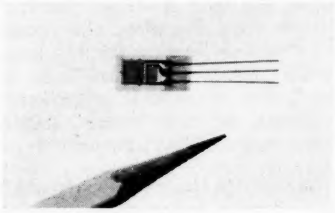


unit can be used to control pressure, temperature, flow, humidity or differential liquid level. A "proportional controller" model is adjustable from 0 to 400%, direct or reverse acting. A "proportional-plus reset" model is adjustable from 0.1 to 100 repeats per min. A "proportional-plus-derivative" model offers an additional adjustment on derivative time from 0 to 10 min. The fourth model is a "differential-gap" controller with an adjustment from 2 up to a full 100% of scale.

For further information write to The Bristol Co., Waterbury 20, Conn.

Strain Gage Simplifies Testing

A bonded resistance foil strain gage—with a built-in computer that solves general stress-strain equations automatically—can substantially reduce testing costs in such industries as aeronautics and missiles by eliminating time-consuming calculation of stresses from strain indications. Two independent strain-sensing elements, oriented 90° to each other, indicate stress along both principal axes, or strain in the axial and transverse direction. The gages can be bonded easily with standard cements for testing



up to 150°F., or with special epoxy cements for elevated temperature (450°F.) applications.

For further information write to Baldwin-Lima-Hamilton Corp., Waltham 54, Mass.

Monitoring of Machine Processes

The "Series 18" Operations Monitor translates amplitude and frequency of signals obtained by pick-up devices on machines or processes into normal and off-normal indications. Panel lamps indicate (and external relays operate) varying degrees of change from desired conditions. Internal logic elements convert selected combinations of these limit signals into normal, alert and alarm relay actions. Applications include determinations of machine tool vibrations; bearing and balance conditions in turbines, pumps, or compressors; material homogeneity inspection and mixing end point; fluid-flow turbulence or cavitation and acoustic process monitoring.

Two data channels, each with two limit levels, may be excited by two separate transducers or they may be used to monitor two character-

istics of a signal from a single pick-up. Signal levels and frequencies are presented on panel meters which may be calibrated in units of vibration displacement, velocity, acceleration, g's, strain, peak strain, pressure, peak pressure, optical reflectivity or sound levels. Frequency of dominant or filtered signals is presented in cps. or cpm. An adjustable multiplier provides 0.5X to 3X expansion of the calibrated scales. The wide frequency range, 2 cps. to 10 kc., and a response to microvolt input signals, permit many types of transducer signals to be used.

For further information write to RayData Corp., Columbus 24, Ohio.

Fog Dispersion Tower

An advance in corrosion testing has been made with the introduction of the "Uni-Fog" dispersion tower which establishes uniformity of salt-fog. The equipment makes possible accurate collection rates on samples in test cabinets. Uniformity is not restricted to repeat tests in one cabinet, but is also accomplished in widely separated locations and various types of cabinets.

For further information write to G-S Equipment Co., 15583 Brookpark Rd., Cleveland 35, Ohio.

Crystal Pulling Fixture

To be used with a high-frequency induction heating system, the "Model HCP-D" unit serves a dual purpose—floating-zone refining and crystal pulling. In crystal pulling, single crystals of various materials, especially germanium, have been successfully grown. A seed of known crystal orientation is brought into contact with the surface of the molten metal and slowly withdrawn, producing progressive crystallization. Basic requirements include: a means of melting material and maintaining temperature slightly above melting point, a desired atmosphere surrounding the melt and growing crystal and a controlled traversing mechanism for moving the induction coil or the material being processed.

All these features are incorporated in the Model HCP-D. The flexibility of the unit should make it useful in process laboratories producing high-purity materials and single crystals of desired orientation.

For further information write to Lepel High Frequency Labs., Inc., Woodside, N.Y.

Flash X-Ray Unit

The "Fexitron Model 210," a small flash X-ray unit weighing 40 lb., is expected to have important applications in research involving small objects at high velocities

(meteorite impact) and in nondestructive testing of components (missile reliability). Model 210 has an unusually high peak power, 140 million watts, and an extremely short exposure time, 3/100 of a millionth of a sec. The X-ray tube is housed in a hand-held pistol grip about the size of a .45 automatic. Like a high-speed camera, sharp photographs are obtained in spite of possible motion because of the very short exposure time. The small tube mount may be remotely connected by a cable to the power source.

The present trend of the electronics industry towards miniaturization places increasing requirements on resolution possible with X-ray equipment. At the same time, missile components are used at higher velocities and accelerations and require very short X-ray exposure times in order to avoid motion blur. The Fexitron unit was designed to meet these requirements. Its very small X-ray source size (1 mm.) and short pulse length will reveal interior defects as small as 2/1000 in. even when components are in rapid motion.

For further information write Field Emission Corp., McMinnville, Ore.

NEW BOOKS

Advances in Cryogenic Engineering, v. 6. Proceedings of the 1960 Cryogenic Conference. K. D. Timmerhaus, Editor. Published by: Plenum Press Inc., 227 W. 17th St., New York 11, N. Y. ($15)

Handbook of Mechanical Wear. Charles Lipson and L. V. Colwell, Editors. Published by: The University of Michigan Press, Ann Arbor, Mich. ($20)

High-Strength Steels for the Missile Industry. H. T. Sumsion, Editor. Published by: American Society for Metals, Metals Park, Novelty, Ohio. ($12)

Progress in Ceramic Science, v. 1. J. E. Burke, Editor. Published by: Pergamon Press, 122 E. 55th St., New York 22, N. Y. ($10)

Report of the Committee on Refractory Metals (Materials Advisory Board Report). Published by: National Academy of Sciences, National Research Council, Washington 25, D. C.

MATERIALS PROBLEMS OF MISSILES, *Rockets and Space Vehicles were defined at a Peoria meeting by William S. Pellini, superintendent, Metallurgy Division, U. S. Naval Research Laboratory. Shown are, from left: W. Short, technical chairman; Mr. Pellini; and W. Lenz, 1961-62 chairman*

Speakers at Saginaw Define Instrumentation in Metallurgy

"Instrumentation for Modern Metallurgy" was the topic covered at a **Saginaw Valley** meeting by A. F. Welch, head of the electronics and instrumentation department, General Motors Research Laboratories, and John L. Harned, project leader on servomechanisms, electronics-instrumentation department, General Motors Research Laboratories.

Mr. Welch discussed portable temperature controllers which can be plugged into main control panels in case of a breakdown. The use of portable auxiliary controllers permits the instrumentation technician to do preventative maintenance on the main controls without interrupting furnace schedules. These portable controls also allow experienced personnel, such as plant protection men, to make quick easy change-overs in case of control failure.

Mr. Welch also discussed analog and digital instrumentation. Analog information is continuous whereas digital information is discreet. Analog computers are more widely used because of their relatively lower cost, ease of operation and the information obtained is continuous and direct.

Mr. Harned discussed recording instruments and their role in dynamic measurement of rapidly varying phenomena. Modern metallurgical work often requires measurements which can be stored for future reference or "read-off" at once.

The typical dynamic measuring instrument consists primarily of a transducer, the matching network and a recorder. While actuation of a recorder can be accomplished by means of direct mechanical linkages, pneumatic or hydraulic pressures, the electrically actuated recorders are used almost universally. These can be listed in five specific categories: self-balancing potentiometer, high-speed pen motor recorder, light beam oscilloscope, magentic tape recorder and cathode ray oscilloscope.

These categories are then broken down into five primary characteristics which are common to all recorders but which influence their selection, depending on the type of performance desired. The five characteristics are: frequency response, accuracy, form of presentation, number of channels and sensitivity.

Frequency response is the most important feature of a recorder. In a pen or stylus type, such as the potentiometer, the high-speed pen motor recorder and the light beam oscillograph, the limit of the upper frequency response is dependent upon the mass of the stylus and drive mechanism. The high-frequency response of the cathode ray oscilloscope is due to the infinitesimal mass of the electron beam. The accuracy of any recorder is affected by linearity, stability, repeatability and resolution. Presentation varies with the type of recorder, but the chart-type direct writing recorder is most universally used since the data can be read and used immediately. Photographic paper allows a faster writing speed and the full chart width is available to each channel on multichannel recording.

The magnetic tape recorder is a memory type where the information can be accumulated, stored and then evaluated. This is desirable where testing of short life tests, undesirable test surroundings or speed is necessary.

The number of channels available on a recorder is important from the standpoint of versatility of the machine and varies from one to two channels for the self balancing potentiometer and the cathode ray oscilloscope to as many as 70 for the light beam oscillograph. There is no real problem to sensitivity because the span can be obtained on all recorders, either by the use of the basic recorder sensitivity or by making use of an accessory amplifier.

The most accurate of all the recorders is the self-balancing potentiometer, since it has a 0.5 accuracy and a frequency response of 1.0 to 100 cps. The light beam oscillograph accuracy is 2%, and its frequency response is 10 Kc. The cathode-ray oscilloscope accuracy is 5%, and its frequency response is 1.0 Mc. The light beam oscillograph, developed widely during the war, is a versatile type of recorder and has the advatnage of low power input, since it uses only 2.5 micro-amp. Two inch to 12 in. wide chart papers running at speeds of ¼ in. per sec. to 120 in. per sec. are used. The magnetic tape recorder is a newer instrument and, along with the cathode-ray oscilloscope, is not too widely used by metallurgical laboratories.

In summing up, both Mr. Welch and Mr. Harned said that laboratories should try to use the magnetic tape recorder and the light beam oscillograph more because of their versatility. In using a wider range of recorders, the engineer will be better capable of evaluating the capabilities of each and to choose the one best suited to a particular instrumentation problem. *(Reported by M. H. Wagner)*

John L. Harned, W. C. Keesder, technical chairman, and A. F. Welch shown during a meeting in Saginaw Valley during which Mr. Harned and Mr. Welch discussed "Instrumentation for Modern Metallurgy".

EMPLOYMENT SERVICE BUREAU

Operated on a no-charge basis for A.S.M. members in good standing. Ads are limited to 50 words and only one insertion of any one ad. Address answers to: Box No., American Society for Metals, Metals Park, Novelty, Ohio, unless otherwise stated.

POSITIONS OPEN

East

SALES MANAGEMENT: Good opportunities for sales and sales management experienced personnel with expanding domestic producer of electrical resistance alloys in wire, rod and strip. Please send resume and territory desired. Box 6-10.

METALLURGICAL ENGINEER: For specialty rolling mill. Desired qualifications: technical experience in metal cladding, rolling, annealing, wire drawing, powder metallurgy; ability to establish and supervise metallurgical aspects of quality control; experienced in planning, directing and assisting in development projects. Excellent opportunity with small growth company. Our staff knows of this advertisement. Salary open. Location, Flushing, N. Y. Send full resume in complete confidence. Box 6-15.

TEACHING OPPORTUNITY—PHYSICAL METALLURGIST: Leading university desires physical metallurgist with teaching and industrial experience. A Ph.D. is essential, also recognized research publications. Must be willing to teach undergraduate and graduate students and direct graduate student research. Salary and rank commensurate with experience and proven ability. Position available September 1961. Box 6-20.

PROCESS ENGINEER: Degree in M.E., Met. E., Met. required, with experience in primary metal processing, casting, extrusion, rolling, drawing, etc., to work in development of physical facilities and mechanical methods for new mill products and in the improvement of existing processes, equipment and products. Understanding of economics of mill operations desirable. Salary $6500-9000 depending upon experience. Southwestern Connecticut. Box 6-25.

CHEMICAL AND METALLURGICAL ENGINEERS: Young, progressive company has responsible research and development positions open for qualified chemical and metallurgical engineers interested in new pyrometallurgy and other extractive metallurgy processes. Salaries open, depending on qualifications. Send resume to Box 6-130.

Midwest

METALLURGIST: Active fundamental research institute has permanent position for a man experienced in preparation of research materials and laboratory techniques of physical metallurgy. Work includes zone melting, crystal growing, vacuum melting and casting and supervision and expansion of equipment, in addition to common melting and forming operations. Salary commensurate with experience. Chicago area. Send resume to Box 6-30.

West

TEACHING: New, growing metallurgical engineering program. Position calls for interest in junior and senior level courses and laboratory development work. Industrial experience desirable, but not essential. B.S. or M.S. in metallurgy necessary. Climate, working conditions and living conditions ideal. Write to: R. C. Wiley, Welding & Metallurgical Engineering Dept., California State Polytechnic College, San Luis Obispo, Calif.

RESEARCH ASSISTANTSHIPS: Graduate program leading to Ph.D. in physical metallurgy. Emphasis on phase equilibria, crystal imperfections, plastic deformation in alloys, ceramics and intermetallics. Full-time summer research employment, half-time during academic year. Stipend $3800-4400 for 12 months plus tuition remission. Contact: Dept. of Metallurgy, University of Denver, Denver 10, Colo.

POSITIONS WANTED

METALLURGICAL AND MAINTENANCE ENGINEER: Degree, age 36. Ten years diversified experience in steel and chemical industries, three years maintenance supervisory experience in large chemical plant. Present position assistant maintenance superintendent. Broad background in the field of industrial engineering. Desires responsible position with company where experience can be fully utilized for mutual benefit. Box 6-35.

METALLURGIST: Ph.D. with 2 years plant metallurgy and 11 years diversified experience in teaching and research. Broad background in chemical and physical metallurgy, ferrous and nonferrous. Cleveland area preferred. Resume on request. Box 6-40.

TECHNICAL MANAGER: Extensive background in process metallurgy and engineering, seeking improved challenging opportunity. Major part in managerial function with leading nationally prominent firms in functions crossing engineering and manufacturing for 25 years. Thoroughly grounded in practical aspects. Creative, imaginative organizer with sound business sense. Northeast. Box 6-45.

METALLURGICAL ENGINEER: B.S., married, age 28. Four years broad ferrous and some nonferrous metallurgical experience in automobile industry. Background includes metallography, heat treatment, failure analysis, contact and trouble shooting, mechanical properties, welding, shot peening, coating and plating. Seeking responsible position in Detroit area. Resume on request. Box 6-50.

METALLURGIST: Young aggressive metallurgist with experience in research and development of high-temperature materials for nuclear reactor applications. B.S. degree plus two years experience in alloy development, powder metallurgy and material evaluation. Desires a challenging position with a good future. Box 6-55.

TECHNICAL SERVICE OR SALES: Age 29. Three and one-half years college metallurgy, currently working on completing degree by correspondence. Five years experience research and development of high-temperature alloys. Would like a position with progressive midwest firm. Travel no object. Available at once. Resume furnished upon request. Box 6-60.

METALLURGICAL ENGINEER: B.S. degree, 10 years experience, 2 years applied research in ferrous primary processing; 3 years applied research in physical metallurgy; 2 years mill processing in high-temperature nickel-base alloys; 3 years primary ferrous mill processing. Interest lies in improving physical and mechanical properties by improved processing techniques and alloy development. Experience includes foundry and wrought products. Box 6-65.

METALLURGICAL OR MANUFACTURING ENGINEER: Age 45, family. Has 4 years steel research, 7 years chief metallurgist steel foundry, 5 years chief metallurgist of nationally known forge shop, 5 years senior engineer engaged in materials, quality control and manufacturing engineering phases of nuclear reactor fabrication. Desires staff or supervisory work offering opportunity in central or northern Ohio. Resume on request. Box 6-70.

METALLURGICAL ENGINEER: B.S. degree, lacking only thesis for M.S. in metallurgical engineering, age 25, family. Four years diversified research and development experience in aluminum, zirconium, stainless and high-strength steel fields. Desires responsible position in research and development or in technical sales. Resume on request. Box 6-75.

METALLURGIST: B.S. and M.S. degrees, Case Institute of Technology, Ph.D., fall of 1961, Lehigh University, all degrees in metallurgy. Married, age 26. Thesis work in high-temperature alloys and welding metallurgy. Desires challenging research and development opportunity. Location open. Available October 1961. Resume on request. Box 6-80.

PLANT METALLURGIST: Many years practical experience and technical training. Foundry experience and nine years nodular iron production. Fifteen years chief metallurgist for a large manufacturing plant. Complete charge metallurgical department, heat treating department, engineering consultant. Resume on request. Box 6-85.

METALLURGICAL TECHNICIAN: Age 28, veteran, married, two children. Graduate of two-year technical college with associate degree in mechanical technology. Presently engaged in quality control materials laboratory work. Experience includes room and elevated temperature testing of ferrous and nonferrous metals, metallography and radiography. Boston, Mass., or surrounding vicinity desired. Resume on request. Box 6-90.

WELDING ENGINEER: M.S. degree, Ohio State University, August 1961. B.S. civil engineering, three years high-temperature metals research as project officer in USAF. Interest in welding metallurgy, applied research, welding process development. Prefers Pacific Northwest or Northern California. Age 26, family. Available October 1961. Box 6-95.

SPONGE IRON MELTER, METALLURGICAL ENGINEER: M.Met.E. degree with ten years operating experience melting sponge iron in all sizes of electric arc furnaces up to 80 tons. Also experience in the production of all classes of electric furnace steels. Resume on request. Box 6-100.

METALLURGICAL SALES ENGINEER: To cover northern Indiana and Chicago area. B.S. degree with 12 years experience in the sale and development of the uses for alloys, ceramics, chemicals and refractories to the steel and foundry industry in this area. Resume sent upon request. Box 6-105.

DIPLOM INGENIEUR: Graduate of technical institute, Aachen, Germany, 28, single. Good background in ferrous metallurgy, experience in process metallurgy of iron and steel. Good command of the English lan-

the 3 minute glass

Elsewhere in this issue you will find photographic evidence of three of ASM's 14 regular committees at work. ASM's committees are effective instruments for assuring the individual ASM member the best in terms of knowledge, service and technical perspective. The three-month period of April, May and June offers a typical sampling of the time and energy devoted by committee members from all parts of the United States and Canada. Two-day meetings are invariably held at Metals Park. Occasional one-day meetings are held at Cleveland Airport, or other points in the country.

The information explosion, as it has been aptly termed, continues to be the major concern of the *ASM Documentation Committee.*

The *Metal Progress Advisory Committee* funnels an interesting array of technical developments to the editorial staff of *Metal Progress.* Such information provides rich resource material, assures the perspective that is continually needed in editorial undertakings and often matures into specific articles for *Metal Progress.*

On Apr. 28 the *Advisory Committee on Metallurgical Education* spent an intensive day. Two of the many topics discussed are designed to make young people more conscious of the field of metallurgy as a career possibility: a metallurgy kit to be made available to the public, and the development, in cooperation with the Boy Scouts of America, of a metal science merit badge. Earl C. Roberts is chairman of this committee.

The preparation of a Chapter Operations Manual, to assist in the sometimes complicated business of carrying on the affairs of an ASM chapter, was a principal item on the continuing agenda of the *Chapter Advisory Committee,* which met on May 18. Chairman of the committee is David C. Heckard.

The *Metals Engineering Program Committee* took pride in the new Metals Engineering Quarterly as it met on May 23 to complete plans for the metals engineering sessions for this October's great Metal Congress in Detroit. John Garol from Tulsa, Okla., is chairman.

Likewise concerned with the 1961 Metal Congress, the chairman of the *Transactions Committee,* T. E. Leontis, presided at a meeting of that group on June 5 and 6 to consider the final group of papers to be presented in Detroit. Incidentally, those papers accepted will appear in the September issue of *Transactions Quarterly.*

The annual budget of the Society for the next fiscal year requires the intensive work and study of the *Finance Committee* which will meet on June 15 and 16, with Treasurer Robert J. Raudebaugh wielding the gavel. The 1962 fiscal year of the Society runs from Sept. 1, 1961, to Aug. 31, 1962.

Later this month N. E. Promisel's *Handbook Committee* will meet in its continuation of work on Vol. 2, and planning for successive volumes of the Metals Handbook. On that same day the *Development Committee,* with William D. Manly in the chair, will continue its important work in encouraging the professional and educational development of ASM members.

Past President A. O. Schaefer is the chairman of the *Long-Range Planning Committee,* which met on May 15 and 16 to gaze studiously into the future. The committee's task is to recognize the needs of members as they may exist five, ten or more years from now.

On June 26 and 27 the ASM Board of Trustees meets at Metals Park to undertake a full agenda, among which are the findings of the committees mentioned. President William Pennington will preside.

Allan Ray Putnam
Managing Director

guage. Desires position with opportunity for advancement. East preferred. Box 6-110.

METALLURGIST: B.S. degree in chemistry, 11 years diversified experience, married, children, veteran. Currently in charge of materials control laboratory producing precision cold drawn tubing for nuclear, missile and military applications. Considerable experience in heat treatment, nondestructive testing, report writing, customer contacts. Desires responsible executive position with small progressive company with opportunity to develop own technical organization. Will relocate. Box 6-115.

METALLURGICAL ENGINEER: B.S., M.S. degrees, married, veteran, age 32. Six years experience in research, development and technical service, mostly in castings field. Publications. Desires technical service and sales or production position. Will relocate. Resume on request. Box 6-120.

TECHNICAL MANAGER: Age 37, Ph.D. degree in metallurgical engineering. Seventeen years diversified experience in research, alloy and process development. Ferrous and nonferrous metals and plastics. Organizing and managerial ability. Presently supervising materials and process research and development. Interested in similar position offering greater opportunity. West Coast preferred. Box 6-125.

Attractive Openings in

METALLURGICAL RESEARCH

Challenging research in new fully-equipped Metallurgical Laboratories in New Haven, Connecticut

METALLURGIST-METALLOGRAPHER

Broad range of Metallography serving an active non-ferrous Metallurgical Research program. Primary emphasis on Aluminum—Base and Copper—Base Alloys.

Opportunity for constitutional studies, interpretation of structures, phase analysis and identification and development of new Metallographic techniques.

B.S. required, preferably in Metallurgy. Minimum of 4 years experience in non-ferrous Metallography.

METALLURGIST

Structural analysis of metals and compounds, texture, in conjunction with orientation studies and development of Radiographic techniques for determining soundness of metal ingots or fabricated parts.

Opportunity for research in Physical Metallurgical problems and Zone Refining of Pure Metals.

B.S. required in Metallurgy. Experience required in X-ray Diffraction, Radiographic and other techniques.

Ideal living with access to major university.
Send resume in confidence to M. F. Tipple,

OLIN MATHIESON Chemical Corporation
275 Winchester Avenue New Haven, Connecticut

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physical

metallurgist—ph.d.

The General Electric Company is seeking a qualified Physical Metallurgist to join the staff of its Materials & Processes Laboratory located at Erie, Pennsylvania. An outstanding career opportunity, this position offers an excellent professional and scientific working climate that includes active collaboration with others in the field of physics, mathematics, chemistry, electrical and mechanical engineering.

Basic Duties: Applied research, development, and application work on metallic materials and processes for locomotive structures and associated mechanical and electrical components.

Qualifications: Ph.D. in metallurgy with an interest in physical metallurgical studies.

Qualified applicants will be invited to inspect laboratory facilities at Company expense. Relocation expense assistance will be provided. Additional information about General Electric's extensive program of Company benefits for employees and dependents is available upon request.

If you meet our qualification, and if you would like to join a Company whose expenditures for research and development are well over three times the average for all industry, send your resume in confidence to: SJ-548

Dr. C. A. Burkhard, Manager
Materials & Processes Laboratory
Locomotive and Car Equipment Dept.
General Electric Company
Erie, Pennsylvania

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The Youngstown Sheet and Tube Company

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RESEARCH METALLURGISTS AND ENGINEERS

Excellent career opportunities for qualified scientists in a program of expansion. B.S., M.S., and Ph.D. degree personnel are required for challenging positions in Research and Development involving both technical and supervisory responsibilities.

Opportunities exist in the general area of iron and steelmaking research including investigations of the properties and application of low alloy steels, fatigue and brittle fracture, coatings and corrosion, new alloy compositions, blast furnace and open hearth analysis and the application of operations research techniques to the optimization of iron and steelmaking practices.

Inquiries for positions in these catagories are invited from current graduates and individuals with a record of prior achievement. Salaries will be commensurate with experience. For prompt and confidential consideration, please send complete résumés indicating area of principal interest to: R. A. Nittinger, Assistant Manager, Organization Planning, The Youngstown Sheet and Tube Company, Youngstown 1, Ohio.

REFRACTORY METAL, SUPERALLOY METALLURGISTS

TAPCO'S expanding Materials Department has openings on its technical staff for metallurgical engineers experienced in high temperature materials, such as refractory metals and superalloys.

Specific openings exist for qualified development and research metallurgists on advanced projects in these fields:

- Metallurgy of nickel, cobalt, titanium alloys
- Plastic deformation and fabrication limitations
- Phase transformation, plastic flow studies
- X-ray diffraction and recrystallization studies
- Powder metallurgy and/or ceramics
- Physical metallurgy of high temperature alloys
- R&D welding programs
- Oxidation and corrosion mechanisms
- Protective coating and/or surface reactions

If you are interested in furthering your career and, at the same time, associating with some of the leaders in these fields, send your resume or contact Mr. R. J. Theibert, Professional Staffing Manager, at the address below.

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One Week MEI Summer Courses

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SUBJECT: PRINCIPLES OF HEAT TREATING

June 26-30 (Mon. thru Fri.) Philadelphia, Pa.—George Washington Motel
Aug. 7-11 (Mon. thru Fri.) Pittsburgh, Penna.—Conley's Motel
Aug. 23-30 (Wed. to Wed.) Detroit, Michigan—Dearborn Inn
Sept. 11-15 (Mon. thru Fri.) Wallingford, Conn.—Yale Motor Inn

SUBJECT: PHYSICAL METALLURGY

July 17-21 (Mon. thru Fri.) Kent, Ohio—Kent State University Campus

Class size will definitely be limited; to be assured of a reservation, write *now*. Cost is $125.00 per registrant (ASM members may register for $115.00 up to a month prior to class date) and includes daily coffee breaks, lunches, and farewell dinner.

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Please send me information on the one-week course at.....

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